

INVESTIGATING THE PREDICTIVE VALUE OF COGNITIVE STYLE AND  
ONLINE TECHNOLOGIES SELF-EFFICACY IN PREDICTING STUDENT SUCCESS  
IN ONLINE DISTANCE EDUCATION COURSES

By

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This dissertation is dedicated to my parents, William and Roma Jenkins; to my husband, Michael DeTure; and to our two wonderful children, Skylar and Haley.

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Abstract of Dissertation Presented to the Graduate School  
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INVESTIGATING THE PREDICTIVE VALUE OF COGNITIVE STYLE AND  
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SUCCESS IN ONLINE DISTANCE EDUCATION COURSES

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Administrators in a Southeastern community college have found a need to assess students' likelihood of success in a web-based, distance education environment. This study was designed to identify those learner attributes that may be used to predict student success in such a web-based, distance education setting. Students enrolled in six selected web-based, general education distance education courses at one community college were recruited as subjects ( $n = 73$ ). Subjects were given the Group Embedded Figures Test for Field Dependence/Independence and the Online Technologies Self-Efficacy Scale to determine their entry level confidence with necessary computer skills for online learning.

Descriptive statistics were reported for the GEFT, the OTSES, and Final Grade. Multiple regression was used to determine the correlation between scores on the GEFT and OTSES with grades "A," "B," "C," "D," and "F" reported as continuous variables "4," "3," "2," "1," and "0" as used to compute GPA. Results showed a significant positive correlation between the GEFT and the OTSES scores. This finding supports the



notion that field independent students tend to be more confident with online technologies. However, results of the regression indicate that neither the GEFT nor the OTSES scores were useful predictors of success in terms of grade. The results of this study contribute to the future identification of student characteristics that may predict success in web-based distance education courses.

## CHAPTER 1 INTRODUCTION

The goal of this study was to investigate relationships among learners' cognitive style, online technologies self-efficacy, and student success in terms of grade within a web-based, distance education environment. Two distinct characteristics of cognitive style (measured as field independence or field dependence) and online technologies self-efficacy were examined to determine whether these variables could be used to predict student success with a web-based distance learning experience.

### Statement of the Problem

To meet the needs of increasingly high numbers of nontraditional students, higher education institutions are offering an ever-increasing number of distance education opportunities. The National Center for Education Statistics reported that 62 % of all public 2-year higher education institutions offered distance education courses in 1997-1998 and another 20 % planned to offer distance courses in the next three years (NCES, 1999). Although distance education has been offered for several decades, beginning with correspondence courses, and then later with telecourse formats and two-way video conferencing, the world-wide-web has become the newest frontier for distance education offerings. Increases in distance learning offerings in the last several years are primarily web-based offerings. Many believe that most new distance offerings will continue to be primarily web-based (Mehrotra et al., 2001). Web-based distance learning environments provide access to education for many students who cannot easily commute to traditional on-campus courses or to remote video-conference sites.

Web-based courses also allow student access at times when traditional on-campus courses are not typically offered. These benefits of online instruction are possible because of personal computers and the internet: an international network of linked computers that all use a specific set of communication rules known as TCP/IP (Transmission Control Protocol/Internet Protocol). Instructors are able to upload a wide variety of course materials to a server from which students can access and interact with the materials at their convenience. Dynamic communication between instructors and learners is established via e-mail and discussion boards (asynchronous or time delayed) and chats (synchronous or real-time) that may or may not involve the use of digital whiteboards for presenting graphic images. However, the same technologies and processes that give web-based instruction its advantages and flexibility may also produce specific challenges for the distance learner. These challenges could include navigation of the course and external links and adapting to the self-directed nature of the learning environment. These challenges quite possibly affect student success rates and may also contribute to the relatively high attrition rates found in many distance education programs. Do students who are able to meet these challenges share certain characteristics? Could these characteristics then be used to predict student success in web-based distance education settings? This study is designed to answer these questions.

An important concept in the distance learning research is that of interaction. Early criticisms of distance education approaches focused on participants' separation in time and space throughout the teaching-learning experience. It was thought that this separation would affect student outcomes in distance learning environments. This argument, however, assumes that meaningful interactions always exist in the traditional

classroom and that physical separation of participants necessarily excludes meaningful interactions. Research has not borne out this criticism. Gross comparisons in learning outcomes and student satisfaction have typically found no significant differences between distance learning and face-to-face environments. A more helpful line of inquiry was established by Michael Moore in 1980. Moore's theory of transactional distance suggests that distance can be a factor in both traditional and distance learning environments. Saba and Shearer (1994) support Moore's definition of transactional distance as a function of structure and dialog: when dialog increases, structure decreases, and transactional distance also decreases. Moore (1989) has also categorized distance education interactions into three types: learner-content, learner-instructor, and learner-learner. A fourth category, learner-interface, was added by Hillman, Willis, and Gunawardena (1994) because unlike traditional classroom interactions, distance education requires interfacing with technologies to make interactions in the other three categories. Therefore, future research in distance education, then, should focus on student attributes, task demands, and instructional design aspects that contribute to student success and satisfaction with the learning experience (Perraton, 2000; Saba, 2000).

Research on the cognitive style dimension field dependence and independence originating with Herman Witkin showed that those subjects who readily disembed a figure from a larger visual field (field-independents) have different processing strengths and weaknesses than subjects who are less able to disembed the figure from the larger visual field (field-dependents). Over a wide range of procedures, field-independent persons are more skilled in cognitive restructuring while field-dependent persons are more skilled in interpersonal relations. In fact, field-dependent persons rely more on

external sources for information such as standards for judgment and action while field-independent persons rely more on internal information and are more autonomous in social situations (Goodenough, 1986). These findings suggest that the field-independent person may be better suited to the task demands of a web-based, self-directed learning environment. It also suggests that field independents may prefer higher levels of autonomy (lower structure) in a distance education setting while field dependents may prefer higher levels of interaction (higher dialog). It is important to note that the suggested preferences of both field independents and field dependents are for lower transactional distance.

An important concept in student success research is that of self-efficacy. Bandura (1986) defined self-efficacy as “people’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performances.” Researchers emphasize that self-efficacy measures should match as closely as possible the necessary skills for target performance; and that one type of self-efficacy may emerge with more predictive power than another depending on the match between the self-efficacy measure and the criterial tasks (Joo et al., 2000). Computer self-efficacy is one of the most important factors determining success with computer-based or web-based instruction. We assessed students’ self-efficacy beliefs regarding online technology use because skill and comfort with online technologies comprise major criterial tasks in a web-based distance education setting.

Although research thus far has found no significant differences in learning outcomes and satisfaction between completers of distance education courses and peer completers of traditional courses, attrition rates are often higher in distance education

courses than in traditional courses. The relatively high numbers of withdrawals in distance education courses is as yet unaccounted for in the research and has been problematic for researchers. Carr (2000) suggested that there are two popular explanations for the high attrition rates in distance education courses. The first explanation is that the demographics of distance education students explain the higher drop rates, as these students are often older and carry more obligations than their on-campus peers. The second explanation is that the nature of distance learning contributes to the higher drop rates; and that some students simply do not get the interaction that they need in the distance learning environment. Some evidence that student-faculty interaction is a significant predictor of persistence and that student-faculty interaction is more important than student-peer interaction (Pascarella and Terenzini, 1977).

One problem is that the reporting of completion rates varies from one institution to another. Some schools do not report students who drop during the scheduled drop-add period at the beginning of a term, while others do (Carr, 2000). While this fact may account for some of the variance in reported completion rates in distance education courses across institutions, it is likely that other factors are involved. The discrepancy in completion rates between institutions is substantial in that some schools report completion rates of 80% while others report that only 50% of DL students complete their courses (Carr, 2000).

Though much research has been conducted on both computer-mediated instruction and distance learning, there have been relatively few research studies on distance learning environments that rely entirely on computer-mediated instruction. Our

study was designed to determine whether or not learners' cognitive styles and online technologies self-efficacy could be used to predict student success in a web-based distance education setting.

### Need for the Study

Research in distance education typically shows "no significant differences" in learning outcomes between traditional (face-to-face) instruction and distance learning in any form (IHEP, 1999). However, criticisms of distance education research and the dearth of research on web-based instruction leave many unanswered questions about the efficacy of this delivery system for all learners. In a report prepared for the National Education Association, the Institute for Higher Education Policy (1999) states the following as weaknesses in the distance education research:

- It does not consider differences among students.
- It does not consider how the different learning styles of students relate to the use of particular technologies.
- It does not include a theoretical or conceptual framework.
- It does not adequately explain why the drop out rate for distance learners is higher.

In addition to these general needs in the research, many institutions are being asked by accrediting agencies to identify factors that predict student success in web-based distance education environments for admission and counseling purposes. Currently, many institutions offer students an informal self-assessment to determine readiness for web-based coursework. These assessments typically ask questions related to motivation, self-discipline, need for interaction with others, and computer experience. These assessments, however, are currently not validated by the research. To help students make wise enrollment choices and to help them succeed with their choices, further investigation of factors that affect student success is necessary.

### Differences Among Students

Most research on distance education compared groups enrolled in distance courses with a peer group enrolled in an on campus course. This type of research ignores individual differences (within groups) that may affect individual achievement and success in each type of course. Furthermore, unless students are selected and matched for individual differences (such as cognitive style and confidence with relevant technologies), students may naturally self-select into the course type that is most suited to their preferences and experience level. One example of this possibility is found in a study by Miller (1997) in which subjects were all adults enrolled in one or more agriculture distance education courses at a Midwestern university (n = 191). Miller found that both male and female subjects in this study scored higher on the Group Embedded Figures Test than the original norm group reported in the GEFT manual. This finding suggests that those students who choose to enroll in distance education courses tend to be field independent.

Cognitive style. The most extensively investigated cognitive style construct is Herman Witkin's field dependence and independence. Witkin, et al. (1977) noted that field dependence and independence are process variables describing pervasive and relatively stable ways of perceiving, orienting, and functioning. The pervasive quality of this dimension refers to the predictable nature of functioning across situations. Witkin also stressed that field dependence and independence is a relative measure rather than a discrete measure, meaning that individuals are not either field dependent or field independent; but are rather relatively more field dependent or relatively less field dependent. Furthermore, Witkin holds that these relative measures are value-neutral,



meaning that relatively field dependent and relatively field independent persons express qualities that are helpful in different circumstances, but that one inclination is neither better nor worse than the other (Korchin,1988).

Of particular interest to this study are the research findings on field dependence and independence in hypermedia or computer-mediated environments. Most studies in this area have found that field-independents are more efficient in search and navigation tasks, while field-dependents are more likely to report feeling lost and disoriented (Kerka, 1998). Also of interest is research that has investigated field dependence and independence related to distance education. Miller (1997) compared field dependent and independent subjects' attitudes toward two different distance methodologies (videotape and interactive communications network). Results showed that field-independents were more inclined to enroll in additional courses using either distance medium; and that, overall, field dependent subjects were more satisfied with the interactive communications network. This finding supports the idea that field independents are more comfortable with distance education environments in general; and that field dependents prefer higher levels of interaction in a distance education environment.

Self-efficacy. During the past 2 decades, researchers have produced a body of evidence showing that students' self-efficacy beliefs to have a strong and positive influence on student motivation and achievement (Joo et al., 2000). Schunk (1983) showed that as students' self-efficacy beliefs get stronger, student performance also improves. Bandura's self-efficacy theory states that self-efficacy beliefs are influenced by four major sources: mastery experiences, vicarious learning, verbal persuasion, and affective states. Direct experience, then, is not the only determining factor in self-

efficacy. Self-efficacy researchers stress the importance of matching the self-efficacy measure with the desired performance criterion. Therefore, we used the Online Technologies Self-Efficacy Scale will be used in this study to determine whether student self-efficacy beliefs toward online technologies can be used to predict success in a web-based distance education setting.

Are there relationships between cognitive style differences and student success with a web-based distance education course? Do relationships exist between online technologies self-efficacy and student success with a web-based distance education course? This study was developed to investigate these questions.

### Hypotheses

This study was designed to answer research questions regarding factors that affect upon student success in web-based distance education courses. The research questions are stated in the form of the following null hypotheses:

- Cognitive style scores cannot predict student success (in terms of grade) in web-based distance education courses.
- Online technologies self-efficacy cannot predict student success (in terms of grade) in web-based distance education courses.

### Limitations

The interpretation of results from this study is subject to the following limitations and assumptions. The results of the GEFT and the OTSES used in the study assume that students answered all questions independently, honestly, and to the best of their abilities. Additionally, students participated on a voluntary basis and were encouraged to participate with the offering of extra credit points. Participating students, then, may differ from their nonparticipating peers. Conclusions drawn are limited to the population

represented by the sample and to the distance education modality utilized.

Generalizations of findings to other populations should be made with caution and will require replication of results.

### Summary

Institutions of higher education are continually striving to meet the needs of the steadily increasing numbers of non-traditional students seeking educational experiences. Simply providing access to these students, however, is not enough. Institutions need to be armed with research-driven information in order to help students determine their readiness for web-based distance learning environments. Research is needed, then, that will clarify the relationships between student characteristics and student success in web-based distance learning environments. Chapter 2 includes a review of theory and research relevant to this study. It is evident that much research has been done in the areas of cognitive style, distance learning and computer-mediated instruction separately, but that there is a scarcity of research that focuses on distance learning mediated entirely by computer technologies, particularly the implications of cognitive styles and online technologies self-efficacy for student success in web-based distance education courses.

## CHAPTER 2 LITERATURE REVIEW

### Overview

This study was designed to explore possible relationships among learners' cognitive style (field dependence and independence), learners' online technologies self-efficacy and student success in terms of grade with a web-based distance education experience. The research questions in this study were developed in conjunction with an analysis of theories and research on distance education, cognitive styles, and computer-mediated instruction. This chapter summarizes the literature relevant to the research questions addressed in this study.

### Distance Education

The field of distance education has existed since the 1840s. The search for a unifying theory of distance education has been struggled with for decades. Currently, many definitions of distance education exist. Several theories of distance education have also been developed. Agreement on a definition and the development of a unified distance education theory have been difficult partly because of the variety of forms of distance education and the variety of technologies used. Correspondence study, tele-conferencing, two-way video-conferencing, and more recently web-based courses are all included in the term distance education. Each of these modes of instruction is as different from the others as it is different from traditional classroom teaching. A major point of contention in the struggle to define the field is what degree of distance is

necessary between instructor and student to qualify a course as distance education. Does a course that is primarily conducted under distant circumstances but that also includes scheduled face-to-face meetings remain categorized as distance education, or does this “hybrid” course fall into another category altogether? Furthermore, while some scholars view distance education as a distinct form of education, others argue that the only distinction between education and distance education is the distance (Shale, 1988). For the purposes of this study, however, distance education refers to the organized educational experiences (supported by an institution) that involve the separation of teacher and student and that allow for two-way communication. For example, Moore (1973) defines distance education:

. . . the family of instructional methods in which the teaching behaviors are executed apart from the learning behaviors, including those that in a contiguous situation would be performed in the learner's presence, so that communication between the teacher and learner must be facilitated by print, electronic, mechanical or other devices.

These definitions do not exclude distance courses that include scheduled face-to-face classroom time and they do not define distance education by the media used. The term distance teaching refers to the instructors' roles in distance education while the term distance learning refers to the students' roles. However, both distance teaching and distance learning are needed for distance education to occur (Keegan, 1986).

Keegan (1986) categorized substantial contributions to distance education theory into three groups: theories of independence and autonomy, theories of industrialization, and theories of interaction and communication. The theories that fall into the categories of independence and autonomy and interaction and communication are most relevant to this study. Therefore, theories of industrialization, which are concerned primarily with automation of processes and cost-effectiveness, are not discussed.

A pioneer scholar in the category of independence and autonomy, Charles Wedemeyer was a proponent of independent study; he suggested that to bridge the time and space barriers of traditional education it would be necessary to separate teaching activities from learning activities (Keegan, 1986). Wedemeyer described education as comprising four elements: a teacher, a learner, a communication system or mode, and something to be taught and learned. This description of education is similar to the basic communication model: sender, receiver, medium, and message. Wedemeyer envisioned the traditional classroom as a box that encompassed these four elements, and he pointed out that:

... distance has long been a problem in the classroom model. As classes become larger, and lectures replaced the dialogue that Plato conducted, the integrity of the model was breached. Only the illusion of being effectively face-to-face remains, as distance within the box lengthens between teachers and learners and speech is amplified for ever more distant reception. The concept of 'distance' involves more than physical distance. There is social distance, cultural distance, and what I have been calling 'physical' distance for want of a better term. All of these are present wherever teaching and learning are carried on. (Wedemeyer, 1978)

To achieve education without time and space barriers, he suggested that the box be redrawn to encompass the teacher and teaching acts with a separate box for the learner and learning acts. Additionally, Wedemeyer's writings promoted self-pacing, individualized instruction, and learner choice in the selection of goals and activities. The writings of Wedemeyer seem to foreshadow Moore's work with transactional distance.

Michael G. Moore is a noted scholar and theorist placed by Keegan into the first category, independence and autonomy. Moore proposes classifying distance education programs by two variables: distance and autonomy. Distance is determined by measuring a program's ability to support two-way communication (dialog) and the extent to which it is flexible in responding to student needs (structure). Autonomy is a measure of the

student's ability to determine his own objectives, learning activities, and evaluation measures.

The first part of Moore's theory, a construct coined transactional distance, has been supported in the research. Saba and Shearer (1994) report that transactional distance is indeed a function of structure and dialog in a course: as structure increases, dialog decreases and transactional distance increases. Bischoff (1993) confirmed that dialog and structure predict transactional distance. The second part of the theory regarding autonomy requires additional justification, according to Keegan (1986) as there is some confusion as to how autonomy relates to transactional distance. Moore has suggested that more autonomous learners (such as field independents) can be comfortable with higher levels of transactional distance and that learners are required to be more autonomous when there is low dialog (1972). Field dependents, then, may be at a disadvantage when there is low dialog and they are required to work autonomously, which is not their preferred mode. Though Moore has consistently called for research on transactional distance, few studies have been done to date, and no studies have been done on students' perceived level of transactional distance and web-based distance education environments. The studies that have been done focus primarily on confirming the functions of structure and dialog in transactional distance and provide little insight into how transactional distance affects the learner's achievement or satisfaction with the distance education experience.

In a study by Chen and Willits (1998) of transactional distance in a two-way videoconferencing course, structure and autonomy did not affect perceived transactional distance; only dialog was important. Furthermore, in a qualitative study of life circumstances and transactional distance in a two-way video conferencing format,

Hopper (2000) found that even students who reported feeling high transactional distance were satisfied with their experience and with their level of achievement. This study, however, included only thirteen responding subjects and no quantitative data on achievement. It is clear that further research is needed to determine whether or not transactional distance correlates with student success or satisfaction in specific distance education settings.

Baath, Holmberg, and Daniels are all contributors to Keegan's category of interaction and communication. Baath's work also seems to be a precursor of Moore's work in that he established the importance of two-way communication in distance programs and pointed out that models that emphasize teacher control of fixed goals (structure) are less likely to promote emphasis on two-way interaction (dialog). Holmberg's major contribution was the concept of guided didactic conversation of which he wrote:

A considerable portion of all oral tuition can rightly be described as didactic conversation. In a great number of successful correspondence courses the atmosphere and style of such conversation is found. It is typical of the style of didactic conversation that advice is given on how to tackle problems, what to learn more or less carefully, how to connect items of knowledge discussed in different lessons and this also characterizes many good correspondence courses. It seems to me that advice and suggestions should preferably be expressed in phrases of personal address, such as 'when you have read the paragraphs, make sure that. . . .' (Holmberg, 1960)

Holmberg believed, then, that promoting a sense of personal relation in distance learning materials would lead to motivation and learning satisfaction. John Daniel struggled in his work with the ideas of interaction and independence, and he suggested that a primary goal in the development of distance programs is to find the right balance between the two. Daniel clearly thought that designing for complete independence was designing for



complete failure and that some level of interactivity, feedback, and pacing were necessary for student success. If the word “structure” is substituted for “independence” and the word “dialog” for “interaction” then the influence of Daniel on Moore is apparent as well. A balance between dialog (interaction) and structure (independence) is necessary to achieve an ideal transactional distance, presumably in the classroom or in a distance education setting.

The contributions made by these theorists in the categories of independence and autonomy and interaction and communication provide a guiding influence to the current study. Wedemeyer and Moore both suggest that distance is more complex than mere geography. Baath’s emphasis on two-way communication, Holmberg’s emphasis on communications that promote feelings of personal relationship, and Daniel’s emphasis on finding a balance between interaction and autonomy are related to the influence of cognitive style on student success in distance education courses. It is thought that field dependents may require more dialog/interaction to be successful and satisfied with courses while field independents may need more autonomy (less structure). In terms of transactional distance, both field dependents and field independents seem to want less transactional distance. Therefore, unless the balance of dialog and structure is just right, we might expect either field dependents (if dialog is too low) or field independents (if structure is too high) to be at a disadvantage.

#### Direction of Research

Early criticisms of distance education focused on the separation between teacher and learner and it was thought that this separation would affect quality of instruction and student outcomes. Proponents of distance education, however, believe that the design of the instruction is more important than the distance. Early research in distance education

focused heavily on comparisons of achievement and satisfaction between distance courses and traditional courses in order to determine whether distance education could provide the same degree of academic quality delivered in the traditional classroom. This type of comparative research has been widely criticized for weak designs, "specifically in regard to control of the populations being studied, the treatments being given, and the statistical techniques applied" (Moore and Thompson, 1997). Other weaknesses attributed to distance education research include a lack of theory-based research questions and the failure to account for differences among individual learners, particularly how learning styles affect upon the use of particular technologies (IHEP, 1999). Nevertheless, decades of research have come to show that distance education can be equally as effective as traditional education in terms of achievement, student and teacher attitudes, and return on investment (Moore and Thompson, 1997). It is no longer necessary to prove that students can and do achieve equally as well in distance education settings as in traditional settings. What is needed now is an understanding of what kinds of learners succeed more readily in particular distance education technologies and why.

More recently, research in distance education has begun to address individual differences and instructional design variables that may be related to subsequent student success and satisfaction with distance education environments, but many questions still remain concerning the suitability of individual learners to specific distance education technologies. This line of research is of particular importance as institutions struggle to base admission requirements and student advisement on research findings. In addition, by identifying student characteristics that correlate with student success in distance learning courses, we may come to a better understanding of the attrition problem in distance education. Diaz (2000) states that:

Educational researchers, in order to determine the future of distance education, should focus on student success rather than on teaching modalities. Studies that focus on comparing student characteristics, evaluating overall student success, and profiling successful (and non-successful) students might better help us attain that which we all seek: more successful students.

With this line of inquiry, Diaz (2000) also points out that randomly assigning subjects into distance education treatments may seem to increase generalizability in theory, but that actually the samples studied in this manner may not be representative of those students who self-select into distance courses. However, profiling characteristics of students who enroll and succeed with distance education modalities could provide insights to designers that could help more students succeed.

#### Student Characteristics

Many researchers have investigated demographic variables such as age, gender, economic status, educational attainment, workload, familial roles, courseload, and GPA in relation to academic success. However, distance education student demographics tend to be different from those of traditional students. Though no evidence exists that distance students can be thought of as a homogeneous group (Holmberg, 1995), distance students are typically older and carry more work and family obligations than their on-campus peers. Also, North American studies have shown that more women are enrolled in distance education than men. Andersen (1994) reports that marital status is significantly different between distance students and traditional students and that the number of distance students' dependents significantly affects academic outcomes. Langenbach and Korhonen (1986) found variables such as age, educational attainment, and previous enrollment in adult education to be significant determinants of persistence for distance learners. Similarly, Beaty (1994) showed age to be a significant determinant of persistence in distance courses and that as age increases, the probability of course

completion decreases. Of particular relevance to this study are studies that have shown that a learner's ability to utilize the delivery system technology and resources affects the level of interaction in a distance education setting (Hillman, Willis, and Gunawardena, 1994). This finding is particularly important in light of the fact that field dependents, who have been shown to be more easily lost and disoriented online than field independents, are thought to require higher levels of interaction for success and satisfaction in a course. This finding also suggests that field dependents with higher online technologies self-efficacy could increase their level of interaction. With students self-selecting into courses, student characteristics may vary significantly from one distance learning modality to another, and some of these factors may contribute to success in one modality and not affect another. For example, computer experience should be an important predictor of student success in a web-based distance learning environment but would probably not be important in a tele-course format.

### Cognitive Style

Cognitive styles have been described as the consistent and enduring differences in individual cognitive organization and functioning (Ausubel, Novak, and Hanesian, 1978), and Keefe (1982) states that cognitive styles are the "cognitive, affective, and physiological traits that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment." Cognitive styles have been studied extensively since the 1970's in an attempt to understand the varying ways that learners perceive and interact with instructional settings, methods, and media. The most widely investigated cognitive style is Herman Witkin's field dependence and independence as measured by the Group Embedded Figures Test. Witkin's early work focused on the importance of visual cues in resolving conflicts, and the rod and frame test

was used to determine subjects' reliance on visual cues as opposed to gravitational cues in adjusting a rod to a vertical position within a tilted square frame. Those subjects who rely more on visual cues, or cues outside themselves, are relatively field dependent, whereas those subjects who rely more on body cues, or cues within themselves, are relatively more field independent. Witkin later created the Group Embedded Figures Test (GEFT), which also determines subjects' relative field dependence and independence by measuring their relative ability to disembed a figure from a more complex visual field. The GEFT has been used extensively since its creation due to its economy and practicality for large-scale administration. Witkin's work suggests that field independents, with their reliance on internal cues, are more autonomous in cognitive restructuring tasks and that field dependent persons are less autonomous in that they rely more on others and the external environment in cognitive restructuring tasks. The relative autonomy of field independents should be an advantage in a distance education setting as Moore (1972) has suggested that autonomy is necessary when there is low dialog and high transactional distance.

Unfortunately, relatively few studies have been done on the affect of cognitive styles or learning styles in distance education. According to Coggins (1988), preferred learning style affects completion of degree programs in distance education. Boverie and Gunawardena (1993) found that students' classification in Kolb's learning style model as accommodators, convergers, or assimilators in a distance setting utilizing audiographic and computer-mediated communication did not affect how students interacted with media or methods of instruction. However, these learning style differences did affect student satisfaction in regard to interactions with their fellow students. Miller (1997) compared field dependent and field independent students' attitudes toward videotaped instruction

and an interactive communications network (ICN). Results showed that field independents were more likely to take additional courses with either videotape or an ICN and that field dependent learners were slightly more satisfied with the ICN than with the videotape. It was proposed that the increase in satisfaction was due to the increase in interaction for field dependents. Gee (1990) found that student differences in Canfield's learning style model affected both attitude and perceived academic achievement in a distance education setting.

Since web-based distance education courses are entirely computer mediated, research on field dependent-independent status in regard to computer and hypermedia use is helpful. According to Stevens (1983), differences exist in computer performance relative to differences in learning styles and cognitive styles though relationships vary along with the learning or cognitive style studied. Kerka (1998) states that field independents are more efficient in search and navigation tasks and that field dependents are more likely to feel lost and disoriented in computer-mediated or hypermedia environments. However, to date, there have been no studies on the affect of field independence-dependence on student achievement in a web-based distance education course.

#### Self-efficacy

Self-efficacy is a term used to describe persons' beliefs about their abilities to complete certain tasks or achieve certain goals. In the last twenty years, self-efficacy has been shown to have a significant affect on student performance, meaning that when confidence levels increase, performance levels increase as well. Self-efficacy concerns persons' confidence in their abilities to complete tasks or reach goals, but is not based entirely on actual experience with performing these tasks in the past. Prior experience,

vicarious learning, verbal persuasion, and affective states are all contributors to self-efficacy, according to Bandura (1986, 1995). Many different measures of self-efficacy exist. There are measures of general academic self-efficacy, math self-efficacy, computer self-efficacy, self-regulated learning self-efficacy, and internet self-efficacy. Research in this field has shown that a specific self-efficacy measure that matches well the desired task performance criteria is a better predictor of performance outcomes than a more general self-efficacy measure. For example, Joo, et al. (2000) showed that scores on an internet search task were predicted by internet self-efficacy and not by academic self-efficacy or self-regulated learning self-efficacy and that scores on a written subject matter test were predicted by academic self-efficacy and not by internet self-efficacy. This finding suggests that although online technologies self-efficacy may predict success with the use of technologies that provide the interface to academic content, academic self-efficacy may be more useful in predicting student success with academic tasks when mediating technologies are not an issue.

### Interaction

The importance of interaction in educational settings has been widely investigated, and it has been shown that students who perceive higher levels of interaction have more positive attitudes (Garrison, 1990; Hackman and Walker, 1990; Ritchie and Newby, 1989) and higher achievement (Navarro and Shoemaker, 2000). Distance education interactions have been categorized by Moore (1989) into three types: learner-content, learner-instructor, and learner-learner. A fourth category, learner-interface, was added by Hillman, Willis, and Gunawardena (1994) because unlike traditional classroom interactions, distance education requires interfacing with technologies in order to make interactions in the other three categories.

Research done on the effects of interactions in distance education environments have provided mixed results (Ritchie and Newby, 1989; Cohen, Ebeling, and Kulik, 1982). In a study conducted to determine predictors of student satisfaction with a fully interactive, multi-point real-time video teleconferencing and web-based course, DeBourgh (1999) found that factors that relate to interaction were of critical importance. The factors found to relate positively and significantly were promptness of answers to student questions, extent of instructor encouragement of participation, accessibility of instructor outside of class, and promptness of instructor feedback on student work. In a comparative study of an online graduate course versus an equivalent traditional course, Johnson, Aragon, et. al (1999) found that although there was no significant difference in learning outcomes between the two groups, there was a significant difference in learners' perceptions of interaction and instructor support, with the online group reporting lower levels for each. Fulford and Zhang (1993) have shown that student perception of interaction predicts student satisfaction but that individual participation is less important than students' perceived level of overall class interaction. Wells (1996) also states that:

... there is no reason to assume that the only students learning from the online interaction are the actual participants. Lurkers may be learners too. (Even face to face classes have their own form of lurkers, i.e. listeners but not speakers).

However, Ting and Jiang (1999) showed that the percent of grade weight on discussion positively affects learners' perceptions of interaction and perceived levels of learning in the course. There is also some evidence that students who are hesitant to participate in classroom situations are more likely to participate in on-line discussions (Ruberg, Taylor, and Moore, 1996; Ting and Jiang, 1999).



### Attrition and Distance Education

Although there are no significant differences in learning outcomes and satisfaction between completers of distance education courses and peer completers of traditional courses, completion rates in distance education courses are often lower than in traditional courses. The relatively high numbers of withdrawals in distance education courses is as yet unaccounted for in the research and continues to be problematic for researchers. There is also a significant difference in completion rates between institutions: some schools report completion rates of 80% while others report that only 50% of DL students complete their courses (Carr, 2000). One problem is that the reporting of completion rates varies from one institution to another. Some schools do not report students who drop during the scheduled drop-add period at the beginning of a term, while others do (Carr, 2000). While this fact may account for some of the variance in reported completion rates in DL courses across institutions, it is likely that other factors are involved. Carr (2000) states that there are two viewpoints on this issue that stem from anecdotal evidence. The first is that the demographics of distance education students explain the higher drop rates as distance students are often older and carry more obligations than do traditional students. The second viewpoint is that the nature of distance learning itself contributes to the higher drop rates and that some students simply do not get the interaction that they need in the distance learning environment. Studies have, in fact, shown that student-faculty interaction is a significant predictor of persistence and that student-faculty interaction is more important than student-peer interaction (Pascarella and Terenzini, 1977).

### Summary

With the increase in distance education offerings, especially web-based offerings in higher education, comes a need to better understand learner characteristics and instructional design variables that affect student success within these environments. Cognitive style and self-efficacy are thought to have some affect on learner achievement and satisfaction in web based distance education settings, but no studies have been done to date that investigate field independence/dependence or online technologies self-efficacy in respect to student success in web-based distance education courses. This study was designed to determine to what degree field independence-dependence and online technologies self-efficacy can predict student success in web-based distance learning environments.

### CHAPTER 3 METHODOLOGY

This study was designed to explore possible relationships between learners' cognitive styles (field dependence and independence) and online technologies self-efficacy with student success in terms of grades in a web-based distance education experience. Students enrolled in the selected online credit classes were given the Group Embedded Figures Test to determine their relative field dependence and independence and the Online Technologies Self-efficacy Scale to determine confidence levels with tasks associated with online coursework. This chapter includes a description of the research design and the methodology used in this study.

#### Research Hypotheses

- Cognitive style scores cannot predict student success (in terms of grade) in web-based distance education courses.
- Online technologies self-efficacy cannot predict student success (in terms of grade) in web-based distance education courses.

#### Population and Sample

The population for this study was defined as community college students in online credit courses. Of a total of 231 online credit courses offered at a southeastern community college in Fall 2002, six general education courses were selected for the study. A total of 163 subjects enrolled in the selected courses, and a total of 73 participated in the study for a participation rate of 45%. Ages of participating students ranged from 18-58 years with a mean age of 27.44. Of the 73 participating students, 79.5% were female and 20.5% were male.

### Research Design

Our study used a causal-comparative research design to explore relationships between variables that could not be easily manipulated and that if studied under manipulated conditions could not yield meaningful results. Six general education online course sections were selected for the study: CHM 1020, Chemistry for Liberal Arts (two sections); BSC2010C, Principles of Biology; GEA1000, World Geography; EUH1000, Western Civilization through 1589; and EDF1005, Introduction to Education. With the exception of the two chemistry sections, all sections were taught by different instructors. The biology section met face-to-face once a week for labs. All six of these courses were taught through either WebCT or Blackboard, online course hosting services. All content, tests, and discussions were provided online. A description of interaction, structure, and grading is provided for each course in Appendix B.

Students enrolled in each of the six sections selected for the study were asked to attend an on-campus meeting during the first week of the course. Students self-selected into these online courses and were aware of the optional on-campus visit in the first week of the course for research-related test administration. Participating instructors agreed to give extra credit points (not to exceed 5% of the total course grade) to participating students, and this information was publicized on instructor web sites. Additionally, a reminder flyer was mailed out to all enrolled students a week prior to the test date. Students were given the opportunity to make alternate test dates to eliminate schedule conflicts as a reason for non-participation. Participants were given the Group Embedded Figures Test and the Online Technologies Self-efficacy Scale. Both tests were paper and pencil tests rather than online tests in order to avoid a bias towards subjects with higher online technologies self-efficacy.

### Data Analysis

Descriptive statistics were reported for the GEFT, the OTSES, and Final Grade. Mean scores of the GEFT and OTSES were reported and analyzed to determine whether scores from individual course sections varied significantly. This was done to determine whether or not student scores on the GEFT and OTSES from all six course sections could be analyzed as a whole. An item analysis was performed on the OTSES and produced a reliability coefficient of .936 which did not differ significantly from the reliability reported by the authors of the instrument. The GEFT and OTSES scores were analyzed to determine if a correlation existed between the two proposed predictor variables. An analysis of variance was performed to determine whether student course grades in terms of GPA differed significantly between course sections. This was done to determine whether final grades from the six course sections could be analyzed as a whole and to rule out the possibility of significant differences in instructors' grading policies affecting the outcomes of the analyses. Multiple regression was used to determine the predictive value of scores on the GEFT and OTSES with grades A, B, C, D, and F reported as continuous variables 4, 3, 2, 1, and 0 as used to compute GPA.

For the purposes of this study failing grades (F), withdrawals (W), withdrawal not passing (NP), and incompletes(I) were coded as 0. The reasoning behind this coding decision was that students in these categories all failed to complete the course successfully and on time whether by choice or due to difficulties with the technology and/or course content. Analyses were run including the W's, I's, and NP's as 0's and once without, but since there were no significant differences in these two analyses, the W's, I's, and NP's were included in the reported analyses.

### Independent Variables

There are two independent variables in this analysis. Field dependence and independence was determined by the subject's score on the Group Embedded Figures Test (Witkin, Oltman, Raskin, & Karp, 1971). Since field independence/dependence is a relative measure rather than a discrete measure, subjects were not classified as either field dependent or independent. Instead, scores were reported as continuous variables. Possible scores on the GEFT range from 0 to 18. Online technologies self-efficacy was defined as a student's score on the 29 item Online Technologies Self-efficacy Scale introduced by Miltiadou and Chong (2000). Possible scores on the OTSES range from 29 to 116. OTSES scores were also reported as continuous scale variables.

### Dependent Variables

There is one dependent continuous variable in this study: student success in terms of final grade. Student grades of A, B, C, D, and F were reported as continuous variables 4, 3, 2, 1, and 0 as used to compute GPA. Final grade information was collected from registrar information on each subject. For the purposes of this study failing grades (F), withdrawals(W), incompletes (I), and withdrew not passing (NP) were all coded as 0. The reasoning behind this coding decision was that students in these categories all failed to complete the course successfully on time whether by choice or due to difficulties with the technology and/or course content. Analyses were conducted two ways: once including the W's, I's, and NP's as 0's and once without, leaving only F's included as 0's, but, since there were no significant differences in these two analyses, the W's, I's, and NP's were included in the reported analyses.

### Instrumentation

The Group Embedded Figures Test (GEFT) was developed by Oltman, Raskin, and Witkin and consists of 18 items presented in three separate timed sections. The duration of the entire test is 20 minutes. The mean score on the GEFT for college-aged males is 12.0 with a standard deviation of 4.1. The mean score for college-aged females is 10.8 with a standard deviation of 4.2 (Witkin, Oltman, Raskin, and Karp, 1971). Reliability for the GEFT was obtained by comparing parallel forms. Correlations between the nine-item first section and the nine-item second section were computed and corrected by the Spearman-Brown prophecy formula, producing a reliability estimate of .82 for both males and females (Witkin, Oltman, Raskin, and Karp, 1971). Validity for the GEFT was determined by finding the correlation to its parent test, the Embedded Figures Test. Correlations for the two tests are reported as -.82 for male undergraduates and -.63 for female undergraduates (Witkin, Oltman, Raskin, and Karp, 1971).

The Online Technologies Self-efficacy Scale (OTSES) was developed by Miltiadou and Chong (2000) to measure students' self-efficacy beliefs in regard to technologies such as e-mail, the internet, and computer conferencing. The OTSES is comprised of 29 items in four areas: internet competencies, synchronous interactions, e-mail interactions, and discussion board interactions. Item responses utilize a Likert scale based on the students' confidence levels with each task. The phrase "I would feel confident" preceeds a list of tasks in each area and response choices are "very confident," "somewhat confident," "not very confident," and "not confident at all." Since self-efficacy is not based entirely on direct experience with tasks, students are instructed prior to completion of the scale to:

Remember that each section begins with the statement, "I would feel confident..." performing an activity, and not, "I have done it before." It does not matter whether you have had experience with the activities described. We would like to find out what your perceptions are in regard to performing the activities described.

The original 30 item scale consisted of 4 subscales, but when factor analyzed for validity, the 4 subscales were collapsed into a single scale and one item was deleted from the scale because the factor loading was indeterminable. The resulting 29 item scale is scored giving four points for each "very confident," three points for each "somewhat confident," two points for each "not very confident," and one point for each "not confident at all." Possible scores, then, range from 29 to 116. The scale was tested by the authors for internal consistency reliability, and a Cronbach's alpha coefficient estimate of .95 was obtained for the revised 29 item instrument. The scale was tested again for reliability with the current student sample scores and produced a Cronbach's alpha coefficient estimate of .936. The full online technologies self-efficacy scale is included as Appendix A.

### Summary

This study was designed to determine whether relationships exist between learners' cognitive styles, learners' online technologies self-efficacy, and student success in terms of grade in web-based distance education setting. Six general education courses were selected for the study. Students self-selected into these courses as recommended in the distance education literature to ensure study of typical distance learners rather than forced distance learners. Students were recruited from these six course sections and were offered extra credit points in their class for participating. At the end of the term, student grades were obtained from the registrar. Descriptive statistics were reported for the GEFT, the OTSES, and Final Grade. T-tests were done to determine whether scores on



the GEFT and/or OTSES differed across course sections. The GEFT and OTSES scores were analyzed to determine if a correlation existed between the two proposed predictor variables. An analysis of variance was done to determine whether Final Grades were significantly different across course sections, and multiple regression analysis was used to determine the correlation between GEFT and OTSES scores and grades A-F.

## CHAPTER 4 RESULTS AND ANALYSIS

### Introduction

This study was designed to explore the predictive value of learners' cognitive styles (field dependence and independence) and online technologies self-efficacy for predicting success in terms of grades in a web-based distance learning experience. Students enrolled in the six selected online credit classes were recruited for participation and given the Group Embedded Figures Test to determine their relative field dependence and independence as well as the Online Technologies Self-efficacy Scale to determine confidence levels with tasks associated with online coursework. Data for this study were collected and analyzed as described in the previous chapter. Descriptive statistics were reported for the GEFT, the OTSES, and GPA. Mean scores of the GEFT and OTSES were reported and analyzed to determine whether scores from individual course sections varied significantly. An item analysis was performed on the OTSES and produced a reliability coefficient of .936 which did not differ significantly from the reliability reported by the authors of the instrument. The GEFT and OTSES scores were analyzed to determine if a correlation existed between the two proposed predictor variables. An analysis of variance was performed to determine whether student course grades in terms of GPA differed significantly between course sections. Multiple regression analysis was then used to determine whether cognitive style and/or online technology self-efficacy could predict student success in terms of grade. Based upon the multiple regression analysis, the null hypotheses were not rejected. A significant correlation was found

between the GEFT and the OTSES. Implications of these results are discussed in the final chapter.

### Results and Analysis

Data for this study were collected and analyzed as described in the previous chapter. Results are reported and discussed separately following a review of the null hypotheses tested.

Hypothesis 1 stated that cognitive style scores cannot predict student success (in terms of grade) in web-based distance education courses. Based upon the multiple regression analysis and the lack of correlation between GEFT scores and Final Grade, the null hypothesis was not rejected.

Hypothesis 2 stated that online technologies self-efficacy cannot predict student success (in terms of grade) in web-based distance education courses. Based upon the multiple regression analysis and the lack of correlation between OTSES scores and Final Grade, the null hypothesis was not rejected.

A total of 163 subjects enrolled in the selected courses and a total of 73 participated in the study for a participation rate of 45%. Ages of participating students ranged from 18-58 years with a mean age of 27.44. Of the 73 participating students, 79.5% were female and 20.5% were male. Descriptive statistics for the GEFT are reported in Table 4-1. The mean scores on the Group Embedded Figures Test for the six course sections are reported in Table 4-2. An independent samples t-test was done to compare the highest (160550) and lowest (164347) scoring course sections on the GEFT. A p value of 0.066 was obtained on Levene's Test for Equality of Variances, and therefore, equal variances were assumed in analyzing the t-test. The t-test produced a p value of 0.013 as reported in Table 4-3, and it was concluded that course sections did not

differ significantly on GEFT score. This finding allowed further analyses to be done with the GEFT utilizing the entire sample as a cohesive whole. Table 4-4 reports the mean scores for males and females which did not differ significantly from the norm scores reported in the GEFT test manual as a mean of 12.0 for males with a standard deviation of 4.1 and a mean of 10.8 for females with a standard deviation of 4.2. Scores on the GEFT did not vary significantly by gender.

Table 4-1. Descriptive Statistics for GEFT

N	Valid	73
	Missing	0
Mean		11.00
Median		12.00
Mode		15
Std. Deviation		5.014
Variance		25.139
Range		18
Minimum		0
Maximum		18
Percentiles	25	7.00
	50	12.00
	75	15.00

\* Multiple modes exist. The smallest value is shown.

Descriptive statistics for the OTSES are reported in Table 4-5. The mean scores on the Online Technologies Self-Efficacy Scale are reported in Table 4-6. A t-test for independent means was done with the highest (160808) and lowest (164347) scoring course sections on the OTSES. Levene's test for Equality of Variances produced a p value of 0.428, and therefore, equal variances were assumed in analyzing the t-test. The t-test showed no significant difference between course sections on the OTSES ( $p = .319$ ) as shown in Table 4-7.

Table 4-2. GEFT Mean Scores by Course ID

Course ID	Mean	N	Standard Deviation
160550	13.00	11	2.898
160620	10.58	12	5.178
160808	11.00	7	5.354
161512	11.33	21	5.073
162501	11.33	12	5.990
164347	8.20	10	4.962
Total	11.00	73	5.014

Table 4-3. Independent Samples T-test between GEFT scores for Course ID 160550 and 164347

	Levene's Test for Equality of Variances		T-test for Equality of Means						
	f	Sig.	t	df	Sig. (two-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of Difference	
GEFT Equal Variances Assumed	3.817	.066	2.739	19	.013	4.80	1.752	Lower 1.132	Upper 8.468

Table 4-4. GEFT Mean Scores By Gender

Sex	Mean	N	Std. Deviation
F	10.74	58	5.111
M	12.00	15	4.645
Total	11.00	73	5.014

This finding allowed for further analyses utilizing the OTSES scores from the entire sample as a cohesive whole. Mean scores on the OTSES are reported by gender in Table 4-8. Scores on the OTSES did not vary significantly by gender. It was noted that approximately 33% of students in the sample scored 116, meaning that they were very confident with all of the tasks in the scale.

Table 4-5. Descriptive Statistics for the OTSES

N	Valid	73
	Missing	0
Mean		106.40
Median		109.00
Mode		116
Std. Deviation		11.778
Variance		138.715
Range		56
Minimum		60
Maximum		116
Percentiles	25	102.00
	50	109.00
	75	116.00

Table 4-6. OTSES Mean Scores by Course ID

CourseID	Mean	N	Std. Deviation
160550	109.18	11	10.304
160620	105.67	12	11.492
160808	109.57	7	9.727
161512	106.43	21	11.626
162501	106.33	12	9.948
164347	102.00	10	17.506
Total	106.40	73	11.778

GEFT and OTSES scores were analyzed to determine whether the scores were correlated. A scatterplot of the scores (Fig. 4-1) indicated that a relationship may exist, and therefore, Pearson's correlation coefficient was computed. A significant positive correlation was found at the 0.01 level ( $p = .305$ ) between scores on the GEFT and scores on the OTSES as shown in Table 4-9.

Table 4-7. Independent Samples T-test between OTSES scores for Course ID 160808 and 164347

	Levene's Test for Equality of Variances				T-test for Equality of Means				
	f	Sig.	t	df	Sig. (two-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of Difference	
OTSES Equal Variances Assumed	.663	.428	-1.032	15	.319	-7.57	7.338	Lower	Upper
								-23.212	8.069

Table 4-8. OTSES Mean Scores by Gender

Sex	Mean	N	Std. Deviation
F	106.34	58	12.026
M	106.60	15	11.160
Total	106.40	73	11.778

This result suggests that more field-independent students also tend to have higher online technologies self-efficacy. Descriptive statistics for Final Grade are reported in Table 4-10, and frequency data for Final Grade are reported in Table 4-11. It was noted that 74% of students in the sample earned a final grade of A or B. Furthermore, only 15% (n=11) of the sample received failing grades, incompletes, or withdrew from the course. Of that 11, two students received an F, four students received a W, four received an I, and one student withdrew not passing NP. W's, I's, and NP's are included and coded as 0's in further analyses since there was no significant difference in the analyses when they were omitted. An analysis of variance was done to determine whether final grades in terms of GPA differed across course sections due to possible differences in instructors' grading policies. The anova produced an  $F$  value of 1.589 ( $df$  5,67) that was not statistically significant at the 0.05 level, (see Table 4-12), and it was determined that Final Grades could be analyzed from the entire sample as a whole.

Fig. 4-1. Scatterplot of GEFT and OTSES

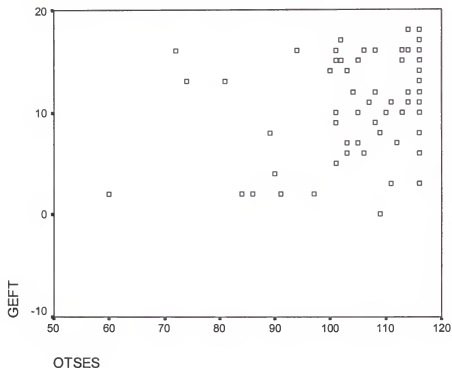


Table 4-9. Correlation of GEFT and OTSES

		GEFT	OTSES
GEFT	Pearson Correlation	1	.305
	Sig. (2-tailed)	.	.009
	N	73	73
OTSES	Pearson Correlation	.305	1
	Sig. (2-tailed)	.009	.
	N	73	73

\*\* Correlation is significant at the 0.01 level (2-tailed).

Multiple regression was used to determine the correlation between scores on the GEFT and OTSES with final course grades A, B, C, D, and F reported as continuous variables 4, 3, 2, 1, and 0 as used to compute GPA. W's, I's, and NP's are included and coded as 0's since there was no significant difference in the analysis when they were omitted.



Table 4-10. Descriptive Statistics for Final Grade

N	Valid	73
	Missing	0
Mean		3
Median		3
Mode		4
Std. Deviation		1
Variance		2
Percentiles	25	2
	50	3
	75	4

Table 4-11. Frequencies for Final Grade

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	11	15.1	15.1	15.1
	1	1	1.4	1.4	16.4
	2	7	9.6	9.6	26.0
	3	20	27.4	27.4	53.4
	4	34	46.6	46.6	100.0
	Total	73	100.0	100.0	

Table 4-12. Analysis of Variance for GPA by Course ID

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	15.173	5	3.035	1.589	.175
Within Groups	127.951	67	1.910		
Total	143.123	72			

The multiple regression analysis was done with the enter method and produced the following model for Final Grade:

$$\text{Final Grade} = 3.220 + .015 \text{ GEFT} - .029 \text{ OTSES}$$

The regression model summary is shown in Table 4-11. The model does not fit the data well since the independent variables (GEFT and OTSES) do not account the variance in the dependent variable, GPA (adjusted  $r^2 = -.028$ ). Neither GEFT scores nor OTSES scores are good predictors of GPA based upon the regression coefficients: GEFT  $t = 0.119$ , OTSES  $t = -0.235$ .

Table 4-13. Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.029	.001	-.028	1	.001	.029	2	70	.972

\* Predictors: (Constant), OTSES, GEFT

### Summary

This study was designed to explore the predictive value of learners' cognitive styles (field dependence and independence) and online technologies self-efficacy for predicting success in terms of grades in a web-based distance learning experience. The study utilized a causal-comparative research design to explore relationships between variables that could not be easily manipulated and that if studied under manipulated conditions could not yield meaningful results. Six general education online course sections were selected for the study: CHM 1020, Chemistry for Liberal Arts (two sections); BSC2010C, Principles of Biology; GEA1000, World Geography; EUH1000, Western Civilization through 1589; and EDF1005, Introduction to Education. Students enrolled in the six selected online credit classes were given the Group Embedded Figures Test to determine their relative field dependence and independence and the Online Technologies Self-efficacy Scale to determine confidence levels with tasks associated

with online coursework. Mean scores of the GEFT and OTSES were reported and analyzed to determine whether scores from individual course sections varied significantly. Results showed no difference in scores across course sections. An item analysis was performed on the OTSES and produced a reliability coefficient of 0.936 which did not differ significantly from the reliability reported by the authors of the instrument. The GEFT and OTSES scores were analyzed to determine if a correlation existed between the two proposed predictor variables. There was a significant correlation at the 0.01 level of alpha ( $p = 0.305$ ). An analysis of variance was performed to determine whether student course grades in terms of GPA differed significantly between course sections. Results showed no difference between GPA across course sections. Finally, a multiple regression was done to determine whether the GEFT or the OTSES could predict student course grade. Results showed that neither GEFT scores nor OTSES scores were good predictors of GPA.

## CHAPTER 5

### CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to determine whether cognitive styles (field-independence/field-dependence) and/or online technologies self-efficacy could be used to predict student success in terms of grade in an online distance education setting.

To implement this study, students from six online general education courses were recruited and given the Group Embedded Figures Test to determine cognitive style and the Online Technologies Self-Efficacy Scale to determine confidence with tasks required in an online course format. These tests were given during the first week of the course before students had a chance to engage with the online course significantly. The tests were administered in a classroom and were paper and pencil tests rather than web-based tests to avoid a bias towards students with higher confidence with online technologies. GEFT, OTSES, and Final Grade scores did not vary significantly across course sections. Therefore, it was determined that the sample could be analyzed as a cohesive whole when running the multiple regression. An analysis of the correlation among variables showed that a significant correlation exists between cognitive style and online technologies self-efficacy, but the multiple regression analysis showed that cognitive style and online technologies self-efficacy were not good predictors for student success in terms of grade. The results of this study in terms of the research hypotheses are presented in this chapter, along with the implications of these results for future research on online distance education and recommendations for additional studies.

## Results

The research questions addressed in this study are examined here based on the results and analyses presented in the previous chapter and subject to the limitations within which this study was implemented. The results of the GEFT and the OTSES used in the study assume that students answered all questions independently, honestly, and to the best of their abilities. Additionally, students participated on a voluntary basis and were encouraged to participate with the offering of extra credit points. Participating students, then, may differ from their nonparticipating peers. Conclusions drawn are limited to the population represented by the sample and to the distance education modality utilized. Generalizations of findings to other populations should be made with caution and will require replication of results.

Hypothesis 1. Cognitive style scores cannot predict student success (in terms of grade) in web-based distance education courses. This hypothesis was not rejected.

Hypothesis 2. Online technologies self-efficacy cannot predict student success (in terms of grade) in web-based distance education courses. This hypothesis was not rejected.

GEFT, OTSES, and Final Grade scores did not vary significantly across course sections. An analysis of the correlation among variables showed that a significant correlation exists between cognitive style and online technologies self-efficacy. Multiple regression analysis showed that both cognitive style and online technology self-efficacy were poor predictors for student success in terms of grade. These results are interpreted in the next section.

### Discussion

A total of 163 subjects enrolled in the six selected courses and a total of 73 participated in the study for a participation rate of 45%. Ages of participating students ranged from 18-58 years with a mean age of 27.44. Of the 73 participating students 79.5% were female and 20.5% were male. The sample studied, which is generally older than traditional college-age and mostly female, is typical of distance learners as identified in research studies of other modes of distance education (Burge, 1998; Thompson, 1998).

Scores on the GEFT were similar to those reported in the test manual for college-aged males and females. This finding is in contrast to that of Miller (1997) who found that students who self-select into distance education courses may tend to be more field-independent than the norms reported in the test manual. Scores on the GEFT did not vary significantly across course sections which was important in the decision to analyze the sample as a cohesive whole. No correlation was found between age and GEFT scores. This finding was expected as cognitive styles are defined as relatively stable measures and are not expected to change significantly with maturation (Witkin, 1977).

The OTSES was analyzed for reliability with the current student sample scores and produced a Cronbach's alpha coefficient estimate of 0.936. OTSES scores did not vary significantly across course sections which was important in the decision to analyze the sample as a cohesive whole. An interesting finding of this study was the fact that approximately 33% of students in the sample scored 116 on the OTSES, meaning that they were very confident with all of the tasks in the scale. One possible explanation for this finding is that students who choose to enroll in online courses tend to be those with confidence that they can meet the technical challenges involved with taking a web-based

course. However, it may also be true that 33% of the general population would score similarly. No correlation was found between age and OTSES scores.

The most interesting result of this study is the significant positive correlation between student scores on the Group Embedded Figures Test and the Online Technologies Self-Efficacy Scale. At this time and with this sample, those students who were more field independent also had higher online technologies self-efficacy. This finding is important in light of the finding by Kerka (1998) that field-independents are more efficient in searching and navigating the internet while field-dependents tend to get lost and disoriented in the search process. One possible explanation is that field-independents tend to be pioneers with new technologies. Another possibility is that there is some underlying cognitive approach that gives field independents an advantage in online tasks. It remains to be seen whether this trend will persist as the general population gains experience and becomes more confident with computer and internet technologies.

Final Grades did not vary across course sections. This result was important to ensure that instructors had not graded significantly more or less rigorously than their peers. The lack of a significant difference in Final Grades allowed the sample to be analyzed as a cohesive whole. It was noted, however, that 74% of students in the sample made an A or B in the course. Furthermore, only 15% (n=11) of students in the sample failed, withdrew, or received incompletes. Of these 11 students, 2 received "F's, four received W's, four received I's, and one received an NP. The high rate of success and relatively low attrition rates in the distance courses studied was surprising. An ad hoc analysis was done to determine whether non-participating students enrolled in the six courses differed significantly on Final Grade from students who participated in the study.

The result showed that there was a significant difference in final grades with participants having higher grades than non-participants. The number of nonparticipants coded as 0 was 26, more than double the number of participants with a score of 0. Of that 26, eight received an F, fourteen received a W, one received an I, and three received a NP. One possible explanation for this difference between participants and nonparticipants is that the participants were more committed to the course from the outset or were more motivated to get higher grades, and therefore, the lure of extra credit points was more enticing to them.

Although participating students who were more field independent were also more confident with online technologies, these characteristics did not correlate with higher grades in this study. No correlation was found between GEFT scores and Final Grade which suggests that neither field independents nor field dependents have an explicit advantage in online distance education courses. It is likely that other student characteristics such as persistence, motivation, previous distance education experience, and academic self-efficacy are intervening variables. It is also possible that the quality and quantity of the interactions (dialog in the form of discussion boards and e-mails) in the courses studied were sufficient to decrease the transactional distance for the field dependent learners and that structure was low enough for field independents.

OTSES scores and Final Grade also failed to produce a significant correlation. This finding is a bit surprising since the OTSES measures criterial tasks for interfacing with web-based course content. It was expected, then, that students who were less confident with the online tasks measured by OTSES would have more difficulty accessing and navigating course content, which would translate into fewer interactions and ultimately more difficulty succeeding in the course. However, Joo (2000) showed



that internet self-efficacy only predicts success with internet tasks and not with academic tasks. Student grades in this study were based on academic assignments and not on their use of the technologies per se. It is likely, then, that an academic self-efficacy measure would have provided a better predictor of course grade. It is likely that other student characteristics, such as persistence and motivation are intervening variables and that those who are motivated or persistent seek the help they need with technical problems rather than suffer in their coursework.

It was noted that although no correlation exists between age and GEFT or age and OTSES scores, there was a significant correlation at the 0.01 level with age and Final Grade (Spearman's Rank coefficient = 0.300). This finding is surprising and in direct contrast to that of Beaty (1994) that older students are more likely to have persistence problems with distance education courses. Again, it is possible that increased student motivation or commitment to the course contributed to this result. It is also possible that more mature students have better self-discipline or time management skills.

### Implications

The results of this study add to the knowledge base used by administrators, faculty, and researchers in distance education design and policy making. With the proliferation of web-based course offerings, it becomes increasingly important to understand why some students succeed with this modality while others do not. Results of this study, implications of these results, and recommendations for future research are discussed below. In reviewing the implications and recommendations, it is important to keep in mind the limitations of the study. Conclusions drawn are limited to the population represented by the sample and to the distance education modality utilized. Generalizations of findings to other populations should be made with caution and will

require replication of results. Given the limitations of the study, the following conclusions may be made.

The results of this study support the notion that field independents tend to be more confident with online technologies than field dependents. This finding suggests that field dependents may benefit from a school-sponsored orientation to online coursework in which students could obtain practice with online skills in order to build confidence prior to enrolling in an online course. In addition, schools may wish to provide a call center for online learners staffed with technicians that can help troubleshoot technical problems with online technologies.

Results of this study also show that age is significantly and positively correlated with student success in terms of final grade in online distance education courses. This finding suggests that maturity may be important in terms of time management and self-discipline.

We can conclude from this study that although students who are more field independent also have higher online technologies self-efficacy, these students do not succeed in their online courses at a higher rate than those students who are field dependent and have lower online technologies self-efficacy. Cognitive style scores and online technologies self-efficacy scores were poor predictors of student success in online distance education courses. This result is important to keep in mind when advising students on whether online distance learning is right for them. The inclusion of questions concerning confidence with technologies and questions based on field dependence and independence on informal pre-screening instruments may generate scores that unnecessarily advise students against enrolling in online distance courses.

### Recommendations for Future Research

The primary purpose of this study was to determine whether or not cognitive style, defined as field independence/dependence and online technologies self-efficacy, could predict student success in terms of grades in online distance education courses. Research into student characteristics that affect student success in distance courses of any kind is scarce and is almost non-existent for online distance education courses. The results of the multiple regression analysis made it impossible to reject the null hypotheses of the study, and it was concluded that cognitive style and online technologies self-efficacy are not good predictors of student success in online distance education courses. Therefore, the following questions are raised as possibilities for future research.

In this study, 33% of the sample scored “very confident” with all tasks included in the online technologies self-efficacy scale. Would the general community college population score just as high on the online technologies self-efficacy scale as the sample in this study, or are those who enroll in online distance education courses more confident with online technologies than their on-campus peers?

Additional studies should be conducted to determine whether academic self-efficacy can predict student success in web-based distance education courses since students are ultimately graded based on academic assignments and not on their technology use. Depending on the subject area of the course, there may be a self-efficacy measure that is even more specific than general academic self-efficacy.

Participants in this study earned significantly higher final grades in their courses than students enrolled in the six courses that chose not to participate in the study. Would the results of the study have been different if all students had participated? Is there a

common trait that is shared by the participants such as increased motivation or commitment to the course that led to higher achievement?

Results of this study showed that students that tended to be more field independent also tended to have higher confidence levels with online technologies. Is there an underlying cognitive restructuring process that gives field independents an advantage in online tasks? Are they simply more experienced with using online technologies, or are they more confident that they can figure out how to use the technologies alone than field dependents are?

Field independents in this study tended to have higher online technologies self-efficacy, but these traits did not translate into higher success rates in their courses. Were field dependents in this study so motivated that they overcame their relative lack of confidence with online technologies to succeed in the courses? If so, what sources of help did they utilize to overcome their lack of confidence with the technologies?

Was transactional distance a factor in the study? Were field independents in this study satisfied with the level of autonomy they had in the course? Would field independents have scored lower if structure in the courses had been higher? Were field dependents in this study satisfied with the quality and quantity of dialog or interaction in the course? Would field dependents have scored lower if dialog or interaction levels had been lower?

Would other student characteristics predict student success with online courses? Future studies should examine relationships between other learning styles such as the Myers- Briggs and student success in web-based distance education courses. Prior experience with distance courses, academic self-efficacy, persistence, work status, number of dependents, age, socio-economic level, and level of family support may all

play roles in student success rates. It is also possible that time spent online engaged with the course materials (time on task) would correlate with student success.

Courses in this study represented differences in interaction, structure, and grading policies. This is typical of distance education courses in higher education as faculty members are typically granted academic freedom to structure their courses as they choose. Further research is needed that compares variables such as structure, dialog, and grading practices among courses to determine whether differences in these variables affect student success and/or satisfaction in web-based distance education courses.

It may be useful to analyze the informal assessments currently provided by institutions to prospective online learners and create a test based on the most often cited questions. A study could then be designed to investigate the usefulness of each question in predicting student success with online distance courses. If no correlation can be found between student answers to these questions and student success in online distance courses, then the use of these tests should be discontinued as some students may be discouraged from enrolling in online courses based on their responses to the questions.

### Summary

This study was conducted to investigate the value of cognitive style (defined as field independence/dependence) and online technologies self-efficacy for predicting student success in online distance education courses. Students enrolled in six selected courses were recruited and given the Group Embedded Figures Test to determine cognitive style and the Online Technologies Self-Efficacy Scale to determine confidence levels with tasks necessary for online coursework.

For this study, a causal-comparative research design was chosen, and students self-selected into courses so that the sample studied would be typical distance learners

rather than forced distance learners. The dependent variable in the study was Final Grade, and the two independent variables were GEFT score and OTSES score. All three variables were analyzed to determine whether scores differed significantly across course sections. There were no differences across course sections, and, therefore, the sample was analyzed further as a whole.

Interpretation of the results of this study was made in awareness of the limitations imposed by the population studied and the distance education modality utilized. Within these limitations, results of the study showed that GEFT and OTSES scores were not good predictors of student success in online distance education courses. There was, however, a significant, positive correlation between GEFT scores and OTSES scores, meaning that more field independent students also tended to have higher online technologies self-efficacy.

Conclusions drawn from this study were limited to the variables as defined and manipulated in the study. Recommendations for future research were made to clarify questions raised by the results of this study as well as to explore other student characteristics and constructs involved in distance education and student success.

In conclusion, this study generated evidence that may be useful to those involved in distance education, including designers, instructors, and policy makers. The evidence gathered suggests that although field independents have higher confidence with online technologies, they are not necessarily more likely to be successful in online distance education courses. The results of this study provide support for the continued exploration of student characteristics and instructional design variables that correlate with student success in online distance education courses.

APPENDIX A  
ONLINE TECHNOLOGIES SELF-EFFICACY SCALE (OTSES)

Name: \_\_\_\_\_

Birthdate \_\_\_\_\_

Sex \_\_\_\_\_

Thank you for agreeing to fill out this questionnaire. The following questions ask how you feel with using online technologies (such as internet and e-mail, etc.) in order to succeed in an online course.

If you do not have much computer experience, just complete the questionnaire to the best of your knowledge. DO NOT WORRY! Remember that each section begins with the statement, "I would feel confident..." performing an activity, and not, "I have done it before." It does not matter whether you have had experience with the activities described. We would like to find out what your perceptions are in regard to performing the activities described. There are no right or wrong answers, just answer as accurately as possible.

Please Read the Directions Below and Then Fill in ALL Items

The survey requires you to indicate your level of confidence with the activities below by placing an (x) in the appropriate column, "Very confident," "Somewhat confident," "Not very confident," or "Not confident at all." If you do not know what a statement means, choose "Not confident at all."

I would feel confident...	Very Confident	Somewhat Confident	Not Very Confident	Not Confident at all
1. Opening a web browser (e.g. Netscape or Explorer)				
2. Reading text from a website.				
3. Clicking on a link to visit a specific website.				
4. Accessing a specific web site by typing the address (URL).				
5. Bookmarking a website.				
6. Printing a web site.				
7. Conducting an internet search using one or more keywords.				
8. Downloading (saving) an image from a website to a disk.				
9. Copying a block of text from a web site and pasting it to a document in a word processor.				
10. Providing a nickname within a synchronous or "live" chat system (if necessary)				
11. Reading messages from one or more members of the synchronous or "live" chat system.				
12. Answering a message or providing my own message in a synchronous or "live" chat system. (one to many interaction)				
13. Interacting privately with one member of the synchronous or "live" chat system.				



I would feel confident...	Very Confident	Somewhat Confident	Not Very Confident	Not Confident at all
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14. Logging on and off e-mail.

15. Sending an e-mail to a specific person (one to one interaction).

16. Sending one e-mail to more than one person at the same time (one to many interaction).

17. Replying to an e-mail.

18. Forwarding an e-mail.

19. Deleting messages received via e-mail.

20. Creating an address book.

21. Saving a file attached to an e-mail message to a local disk and then viewing the contents of that file.

22. Attaching a file (image or text) to an e-mail message and then sending it off.

23. Signing on and off an asynchronous (discussion board) conferencing system.

24. Posting a new message to an asynchronous (discussion board) conferencing system.

25. Reading a message posted on an asynchronous (discussion board) conferencing system.

26. Replying to a message posted on an asynchronous (discussion board) conferencing system so that all members can view it.

27. Replying to a message posted on an asynchronous (discussion board) conferencing system so that only one member can view it.

I would feel confident...	Very Confident	Somewhat Confident	Not Very Confident	Not Confident at all
28. Downloading (saving) a file from an asynchronous (discussion board) conferencing system to a local disk.				
29. Uploading (sending) a file to an asynchronous (discussion board) conferencing system.				

APPENDIX B  
ONLINE COURSE DESCRIPTIONS

160550 BSC2010C: Fundamentals of Biology I

**Interaction** – students in this course met weekly for face-to-face lab sessions where they worked cooperatively in groups. There was no instructor led discussion in the online component of the course and no grade weight attributed to online discussion.

**Structure** – There were no choices in assignments or evaluation measures in this course.

<b>Grading</b> –	5 lecture tests (50 points each)	250 points
	2 lab tests (50 points each)	100 points
	Group lab work	25 points
	Final exam	100 points

Total	475 points
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	<u>Percent</u>	<u>Points</u>
A	90 - 100 %	428 - 475
B	80 - 89.9 %	380 - 427
C	70 - 79.9 %	333 - 379
D	60 - 69.9 %	285 - 332
F	0 - 59.9 %	0 - 284

160808 EUH1000: Western Civilization Through 1589

**Interaction** – Students in this course were required to post to the discussion board 5 out of every 7 days and this component was graded as class participation. The instructor's writing style in all postings was very much one of guided conversation.

**Structure** – Students were allowed to choose the topic for their research paper as long as their topic was a person, place, or event that was important during the time period covered in the course. Students were also allowed to choose between two books on which they could write a book review.

**Grading** – 3 exams

Book Review  
 Research Paper  
 Class Participation

---

Total grades divided by 6 = course grade (letter grades on a 10 point scale)

162501 GEA1000: World Geography

**Interaction** – Students in this class were required to work in online groups to complete a final project in the form of a Powerpoint presentation. No discussion postings were required outside those necessary to complete the group work.

**Structure** – There were no choices for students in assignments or evaluations.

**Grading** – Group project      200 points  
                  Map assignment      200 points  
                  6 exams              100 points each

---

Total possible points = 1000

\* Professor provided no information on how points translated to final grade.

160620 EDF1005: Introduction to Education

**Interaction** – Students were required to post to weekly discussions and to respond to at least one of their peers each week in the discussion.

**Structure** – Students were allowed to choose which Duval County school to visit to fulfill the field experience component of the course. They were also allowed to choose between several different school board meetings to watch on television and write a review for the class. Finally, students were allowed to choose a book on a topic in education to review.

**Grading** – The grading policy stated that points will be awarded for assignments, book review, field experience completion, attendance and discussion activities and that grades will be assigned on a ten point scale.

161512, 164347 CHM1020: Chemistry for Liberal Arts

**Interaction** – There was no instructor initiated discussion and students were not graded on discussion postings. There was no group work.

**Structure** – Students were not allowed choices in the assignments or evaluations.

**Grading** – Grading consisted of a homework assignments, a midterm, and final.

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## BIOGRAPHICAL SKETCH

Monica Lynne DeTure was born Monica Lynne Jenkins on April 19, 1971, in Raleigh, North Carolina. She graduated Paul M. Dorman High School in Spartanburg, South Carolina, in 1988. While in high school, Monica danced leading roles in *The Nutcracker* and *Cinderella* with Spartanburg Civic Ballet Company. Monica earned a Bachelor of Fine Arts from the College of Charleston in Charleston, South Carolina, in 1993. While attending the College of Charleston, Monica performed as a soloist with the Robert Ivey Ballet.

Monica earned a Master of Education degree from the University of Florida in 1996. She then worked as a media specialist in private and public elementary schools in Jacksonville, Florida. Monica is currently a Multimedia Systems Analyst/Instructional Designer for Florida Community College at Jacksonville.

In Jacksonville, Monica also took advantage of the opportunity to cheer for the NFL's Jacksonville Jaguars and was able to travel to Jamaica with the team. She volunteers for the Jaguar's "Honor Rows," and enjoys performing in community theatre.

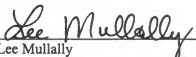
Monica married Michael DeTure in July 1992. They live in Jacksonville with their son, Skylar; and daughter, Haley.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



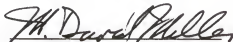
Jeffrey A. Hurt, Chair  
Associate Professor of Teaching and Learning

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



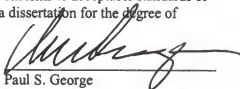
Lee Mullally  
Associate Professor of Teaching and Learning

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M. David Miller  
Professor of Educational Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



Paul S. George  
Professor of Teaching and Learning

This dissertation was submitted to the Graduate Faculty of the College of Education and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

May 2003



Dean, Graduate School